SOLAR/2036-79/03

Monthly Performance Report

PAGE JACKSON SCHOOL

MARCH 1979

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

MONTHLY PERFORMANCE REPORT
PAGE JACKSON SCHOOL
MARCH 1979

I. SYSTEM DESCRIPTION

Page Jackson School is an elementary school located in Charles Town, West Virginia. The solar energy system is designed to provide approximately 85 percent of the space heating and 50 percent of the space cooling energy requirements of the school. It has an array of flat-plate collectors with a gross area of 11,000 square feet that faces south at an angle of 45 degrees from the horizontal. Water is used as the medium for delivering solar energy from the collector array to storage. The solar heated water is stored in two interconnected 10,000-gallon storage tanks and is used for space heating and cooling. When the solar energy is insufficient to meet the heating demands, an oil-fired boiler is used to provide auxiliary hot water for heating. In the space cooling mode, the hot water from storage is supplied to an absorption chiller to generate chilled water. A conventional centrifugal chiller is used as backup whenever solar energy is insufficient to meet the space cooling demand.

The system, shown schematically in Figure 1, has three modes of solar operation.

<u>Mode 1 - Collector-to-Storage</u>: The collector subsystem operates independently of the other subsystems. It is active whenever the solar collector temperature is higher than the temperature in storage (hot water thermal storage). When the hot water thermal storage temperature is equal to, or greater than the collector temperature, solar pump P7 is shut down (pump P8 is a backup pump). An emergency mode of operation to prevent overheating of the collectors is manually activated to allow water to continuously circulate through the collectors.

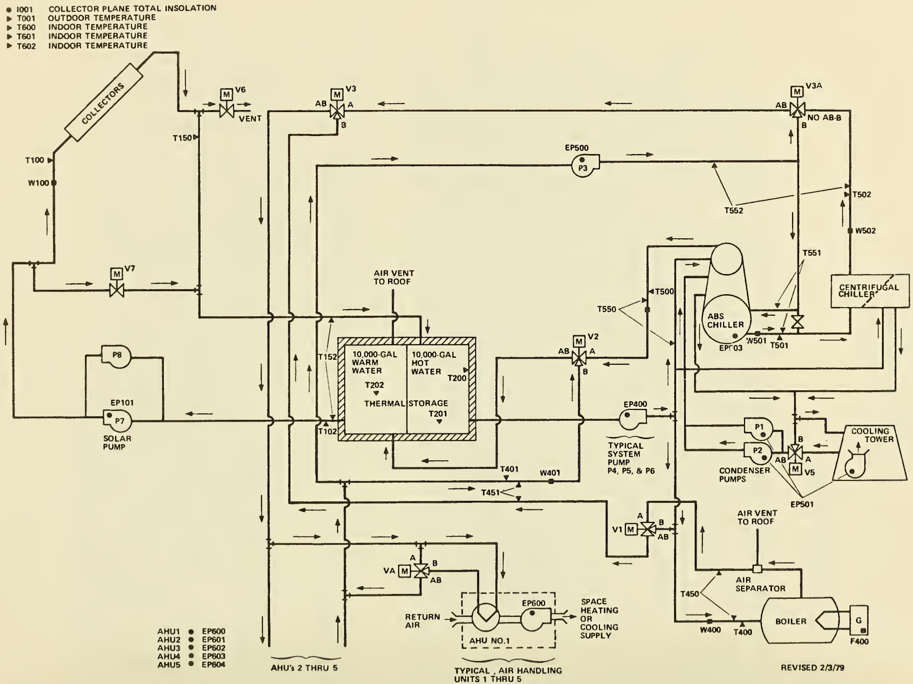

Figure 1. PAGE JACKSON SCHOOL SOLAR ENERGY SYSTEM SCHEMATIC

Mode 2 - Space Heating: This mode is entered when the manual SUMMER-WINTER-AUTOMATIC switch is set to AUTOMATIC and the outside ambient temperature is below 60°F, or when the switch is set to WINTER. Whenever the temperature of the air returning from the air-handling units is below 68°F and the hot water thermal storage temperature is less than 123°F, auxiliary heating is activated. The burner for the boiler is cycled to maintain a water temperature of 160°F. When the hot water thermal storage temperature rises above 113°F, or the return air temperature rises above 68°F, auxiliary heating is shut off.

Mode 3 - Space Cooling: This mode is entered when the manual SUMMER-WINTER-AUTOMATIC switch is set to AUTOMATIC and the outside ambient temperature is above 68°F, or when the switch is set to SUMMER. There are two modes of space cooling; one utilizes the absorption chiller, the other the backup centrifugal chiller. When the hot water thermal storage temperature rises above 180°F, system pumps P4, P5, and P6 are activated to generate flow through the absorption chiller. As the inlet water temperature to the chiller rises above 180°F, the chilled water temperature out of the absorption chiller will become colder. As the temperature from hot water thermal storage drops below 180°F, the reverse will occur. When the hot water thermal storage temperature drops below 171°F, system pumps will stop, and the absorption chiller will no longer be used for space cooling. If there is a demand for space cooling and the storage temperature is below 171°F, the backup centrifugal chiller is used to satisfy the demand.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR-76-1137, Thermal Dataquirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The solar energy system at Page Jackson School operated continuously during March, and satisfied 66 percent of the space heating energy requirements. There was no space cooling during March.

B. Weather

March is past the peak of the heating season in the Page Jackson School area, with a long-term average outside ambient temperature of 45°F. The actual outside ambient temperature averaged 46°F during March. The measured insolation in the plane of the collector array averaged 1,481 Btu/ft^2-day, which is slightly above the expected long-term average of 1,400 Btu/ft^2-day derived from measurements taken at the Washington, D. C. airport.

C. System Thermal Performance

Collector - Of the 504.87 million Btu of solar energy incident on the collector array during March, 460.64 million Btu were incident on the array when there was flow through the collector array. The system collected 122.51 million Btu, or 24 percent of the total insolation incident on the collector array. The operation of solar pumps P7 and P8 required 2.96 million Btu of electrical energy.

Storage - Of the 123.77 million Btu of energy delivered to storage, 119.97 million Btu were solar energy and 3.80 million Btu were auxiliary energy. This indicates a loss of 2.53 million Btu from the system between collection and storage. Some of the 3.80 million Btu of auxiliary thermal energy was extracted from storage for space heating, but instrumentation cannot distinguish between solar or auxiliary energy leaving the storage tank.

The daily average storage temperatures ranged from 93°F to 141°F.

Space Heating Load - Space heating energy requirements were the only demand on the solar energy system during March. The space heating load experienced in March was 181.80 million Btu. This is significantly less (approximately one-half) than the load experienced in February, but still above the design load for March of 159.20 million Btu given in Section IV. Of the 181.80 million Btu, 119.62 were supplied by solar system, and the remainder were from auxiliary thermal energy generated by an oil-fired boiler.

Space Cooling Load - There was no demand for space cooling at Page Jackson School during March.

D. Observations

The sensor W400, which determines the flow rate through the auxiliary heating system, is located in a line where actual fluid flow can be as low as 30 gallons per minute, or as high as 170 gallons per minutes. When the flow is in the lower portion of this range, the calculated value of auxiliary thermal energy used may not be reliable, since a one-bit noise signal from the flowmeter represents 16 gallons per minute. To alleviate this problem, the auxiliary input to the system is currently being calculated as 60 percent of the auxiliary fossil fuel consumed. The flowmeter on the oil burner, F400, is quite accurate and provides a confident value of fuel consumption.

The exact amount of solar energy used cannot be measured or calculated directly. It is normally computed as the difference between the measured heating load and the sum of auxiliary thermal energy used and auxiliary thermal energy delivered to storage. Since the boiler efficiency is being estimated at 60 percent, the solar energy used for space heating is an approximate value. The piping and tanks are well insulated, and, therefore, losses from these components are minimum.

At Page Jackson School, an oil-fired boiler is used to supply hot water for space heating whenever there is insufficient solar energy to meet the heating requirements. However, all hot water used for space heating or cooling must flow from storage to the load and back. This can cause auxiliary energy to be transferred from the boiler to storage. The boiler controls are set to maintain water in the boiler between 120°F and 200°F, thus providing conditions which allow water to flow from the boiler to the load and return to storage at a temperature higher than the storage temperature. This can be observed on a number of days in March, as discussed in the storage performance subsection of this report.

The measured heating load was 181.80 million Btu during March in comparison to a design load of 159.20 million Btu.

E. Energy Savings

The Page Jackson School solar energy system resulted in a fossil savings of 199.36 million Btu during the month of March. The operating expense of the solar energy system was 12.60 million Btu of electrical energy, and converting this to fossil energy yields 42.00 million Btu. Therefore, the net fossil savings was 157.36 million Btu. The fossil energy savings calculations are based on a comparison of the projected energy requirements of a conventional, fossil energy boiler, with an efficiency of 60 percent, and the energy requirements of the solar energy system.

III. ACTION STATUS

None.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: PAGE JACKSON SCHOOL　　CHARLESTOWN, WEST VIRGINIA　　SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

SITE/SYSTEM DESCRIPTION:
THE PAGE JACKSON SOLAR ENERGY SYSTEM PROVIDES SPACE HEATING AND COOLING. THE SYSTEM USES WATER AS A COLLECTION AND STORAGE MEDIUM. HOT WATER FROM THE STORAGE TANK IS DIRECTED EITHER TO IN-DUCT HEATING COILS OR TO THE GENERATOR OF AN ABSORPTION AIR CONDITIONER. A FUEL OIL FIRED BOILER PROVIDES AUXILIARY HOT WATER FOR SPACE HEATING. A CENTRIFUGAL CHILLER PROVIDES ADDITIONAL CHILLED WATER FOR SPACE COOLING.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	504.874	MILLION BTU
	45898	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	122.506	MILLION BTU
	11137	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	46	DEGREES F
AVERAGE BUILDING TEMPERATURE	75	DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.24	
ECSS OPERATING ENERGY	2.958	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	69.024	MILLION BTU
TOTAL ENERGY CONSUMED	323.169	MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	N.A.	181.798	0.000	181.798 MILLION BTU
SOLAR FRACTION	N.A.	66	0	56 PERCENT
SOLAR ENERGY USED	N.A.	119.619	0.000	119.619 MILLION BTU
OPERATING ENERGY	N.A.	66.065	0.000	69.024 MILLION BTU
AUX. THERMAL ENERGY	N.A.	78.984	0.000	78.984 MILLION BTU
AUX. ELECTRIC FUEL	N.A.	N.A.	0.000	0.000 MILLION BTU
AUX. FOSSIL FUEL	N.A.	131.640	N.A.	131.640 MILLION BTU
ELECTRICAL SAVINGS	N.A.	-9.644	-0.000	-12.602 MILLION BTU
FOSSIL SAVINGS	N.A.	199.365	N.A.	199.365 MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.503

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978. SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: PAGE JACKSON SCHOOL   CHARLESTOWN, WEST VIRGINIA   SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

SITE/SYSTEM DESCRIPTION:
THE PAGE JACKSON SOLAR ENERGY SYSTEM PROVIDES SPACE HEATING AND COOLING. THE SYSTEM USES WATER AS A COLLECTION AND STORAGE MEDIUM. HOT WATER FROM THE STORAGE TANK IS DIRECTED EITHER TO IN-DUCT HEATING COILS OR TO THE GENERATOR OF AN ABSORPTION AIR CONDITIONER. A FUEL OIL FIRED BOILER PROVIDES AUXILIARY HOT WATER FOR SPACE HEATING. A CENTRIFUGAL CHILLER PROVIDES ADDITIONAL CHILLED WATER FOR SPACE COOLING.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	532.641	GIGA JOULES
	521215	KJ/SQ.M.
COLLECTED SOLAR ENERGY	129.244	GIGA JOULES
	126471	KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	8	DEGREES C
AVERAGE BUILDING TEMPERATURE	24	DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.24	
ECSS OPERATING ENERGY	3.121	GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	72.820	GIGA JOULES
TOTAL ENERGY CONSUMED	340.944	GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL	
LOAD	N.A.	191.797	0.000	191.797	GIGA JOULES
SOLAR FRACTION	N.A.	66	0	66	PERCENT
SOLAR ENERGY USED	N.A.	126.198	0.000	126.198	GIGA JOULES
OPERATING ENERGY	N.A.	69.699	0.000	72.820	GIGA JOULES
AUX. THERMAL ENG	N.A.	83.328	0.000	83.328	GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	N.A.	0.000	0.000	GIGA JOULES
AUX. FOSSIL FUEL	N.A.	138.880	N.A.	138.880	GIGA JOULES
ELECTRICAL SAVINGS	N.A.	-10.174	-0.000	-13.295	GIGA JOULES
FOSSIL SAVINGS	N.A.	210.330	N.A.	210.330	GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.503

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REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: PAGE JACKSON SCHOOL   CHARLESTOWN, WEST VIRGINIA   SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	10.163	44	3.947	N	0.059	N	0.388
2	21.910	43	3.941	O	0.119	O	0.180
3	13.381	41	4.562	T	0.105	T	0.341
4	0.557	44	2.383		0.000		4.278
5	1.098	56	2.399	A	0.000	A	2.185
6	2.843	45	2.208	P	0.000	P	0.777
7	23.285	40	4.432	P	0.104	P	0.190
8	19.889	44	4.738	L	0.109	L	0.238
9	20.348	47	4.097	I	0.114	I	0.201
10	2.715	49	3.309	C	0.017	C	1.219
11	17.661	30	4.373	A	0.123	A	0.248
12	25.089	35	5.909	B	0.129	B	0.236
13	22.030	47	3.541	L	0.130	L	0.161
14	9.727	48	5.480	E	0.062	E	0.563
15	25.563	26	5.680		0.135		0.222
16	25.245	34	4.876		0.129		0.193
17	24.730	45	4.010		0.129		0.162
18	18.888	48	5.012		0.104		0.265
19	24.561	43	5.568		0.126		0.227
20	24.707	45	5.246		0.129		0.212
21	24.496	48	5.029		0.130		0.205
22	23.701	54	4.104		0.130		0.173
23	18.590	56	2.853		0.113		0.153
24	2.999	53	3.170		0.013		1.057
25	7.703	41	5.037		0.091		0.654
26	10.123	35	1.878		0.080		0.185
27	16.744	38	3.522		0.110		0.210
28	24.810	41	3.638		0.127		0.147
29	20.285	64	2.334		0.129		0.115
30	14.262	69	1.231		0.115		0.086
31	6.671	66	1.113		0.095		0.167
SUM	504.874	-	119.619	N.A.	2.958	N.A.	-
AVG	16.286	45	3.859	N.A.	0.095	N.A.	0.237
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VIRGINIA SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	10.163	6.177	1.640	49	0.161
2	21.910	19.815	5.503	50	0.251
3	13.381	12.522	2.734	45	0.204
4	0.557	0.000	0.000	43	0.000
5	1.098	0.000	0.000	58	0.000
6	2.843	0.000	0.000	46	0.000
7	23.285	18.650	6.023	50	0.259
8	19.889	17.196	5.316	55	0.267
9	20.348	18.745	5.577	57	0.274
10	2.715	0.926	0.108	51	0.040
11	17.661	16.837	3.756	30	0.213
12	25.089	24.393	6.938	42	0.277
13	22.030	21.251	5.896	56	0.268
14	9.727	8.648	2.227	52	0.229
15	25.563	24.941	6.863	27	0.268
16	25.245	24.311	7.029	43	0.278
17	24.730	24.077	6.852	58	0.277
18	18.888	17.797	4.794	59	0.254
19	24.561	23.657	6.802	53	0.277
20	24.707	23.947	7.109	55	0.288
21	24.496	23.705	6.711	59	0.274
22	23.701	22.812	6.350	67	0.268
23	18.690	17.499	3.601	64	0.193
24	2.999	1.397	0.162	57	0.054
25	7.703	6.947	1.419	41	0.184
26	10.123	7.087	0.922	37	0.091
27	16.744	15.894	3.706	44	0.221
28	24.810	23.559	6.386	48	0.257
29	20.285	19.696	5.207	77	0.257
30	14.262	13.088	2.802	79	0.196
31	5.671	5.071	0.076	73	0.011
SUM	504.874	460.641	122.506	-	-
AVG	16.286	14.859	3.952	52	0.243
NBSID	0001		0100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VISOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	1.757	3.047	-1.464	111	1.413
2	5.558	3.941	2.057	119	1.079
3	2.864	4.562	-1.534	112	1.057
4	0.000	2.383	0.040	109	1.000
5	0.264	2.390	-0.491	109	7.232
6	0.184	2.208	0.396	109	14.177
7	5.932	4.432	1.942	119	1.058
8	5.180	4.738	-0.016	120	0.912
9	5.468	4.097	1.081	123	0.947
10	0.130	3.309	-2.994	115	2.416
11	3.667	4.373	-0.119	110	1.160
12	6.849	5.909	0.570	115	0.946
13	5.676	3.541	2.236	119	1.018
14	2.198	5.480	-4.011	114	0.668
15	7.012	5.680	0.785	101	0.922
16	7.109	4.876	1.777	116	0.935
17	6.928	4.010	2.705	126	0.969
18	4.718	5.012	-1.268	126	0.794
19	6.552	5.568	0.110	124	0.867
20	6.586	5.246	0.496	125	0.872
21	6.543	5.029	0.834	120	0.806
22	5.915	4.104	1.257	135	0.906
23	3.480	2.853	-0.157	141	0.775
24	0.162	3.170	-3.993	130	-5.095
25	1.432	5.037	-4.426	102	0.426
26	4.030	1.878	3.270	93	1.280
27	3.527	3.522	0.119	114	1.032
28	6.143	3.638	2.459	120	0.951
29	4.995	2.334	2.156	130	0.899
30	2.932	1.231	0.955	141	0.737
31	0.080	1.113	-2.224	138	-13.808
SUM	123.772	119.619	2.343	-	-
AVG	3.993	3.859	0.076	119	0.085
NBS ID	0200	0201	0202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VIRGINIA SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
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SUM	N.A.	-	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	-	-	N.A.
AVG	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VI SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR. OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	6.067	57	3.947	2.740	3.915	N	6.526	-0.315	6.578	75	44
2	6.676	59	3.941	2.465	3.504	O	5.840	-0.314	6.568	75	43
3	5.138	74	4.562	1.975	2.450	T	4.083	-0.315	7.604	73	41
4	6.204	38	2.383	1.951	6.099		10.166	-0.316	3.971	77	44
5	4.056	59	2.399	2.495	3.527	A	5.878	-0.315	3.999	75	56
6	5.801	38	2.208	2.445	6.148	P	10.247	-0.315	3.681	75	45
7	7.931	56	4.432	2.496	3.922	P	6.537	-0.314	7.386	75	40
8	6.837	59	4.738	2.449	2.363	L	3.938	-0.314	7.897	75	44
9	5.796	71	4.097	2.436	1.815	I	3.026	-0.314	6.829	75	47
10	4.203	79	3.309	1.937	1.876	C	3.126	-0.315	5.515	73	49
11	8.475	52	4.373	1.941	5.240	A	8.734	-0.316	7.288	71	30
12	10.172	58	5.909	2.491	4.334	B	7.223	-0.315	9.849	73	35
13	6.871	52	3.541	2.437	3.412	L	5.686	-0.312	5.901	75	47
14	5.483	100	5.480	2.458	0.003	E	0.005	-0.312	9.134	75	48
15	10.767	53	5.690	2.471	5.116		8.527	-0.313	9.467	73	26
16	9.720	50	4.876	2.481	5.163		8.605	-0.313	8.126	75	34
17	6.038	56	4.010	1.951	2.141		3.568	-0.312	6.683	74	45
18	5.012	100	5.012	1.922	0.000		0.000	-0.312	8.354	75	48
19	6.250	89	5.568	2.362	0.682		1.137	-0.312	9.280	76	43
20	6.272	84	5.246	2.444	1.077		1.796	-0.312	8.743	76	45
21	5.029	100	5.029	2.144	0.000		0.000	-0.311	8.382	77	48
22	4.108	100	4.104	1.976	0.004		0.006	-0.310	6.840	77	54
23	2.853	100	2.853	1.596	0.000		0.000	-0.308	4.755	76	56
24	3.170	100	3.170	1.901	0.000		0.000	-0.310	5.283	75	53
25	5.037	100	5.037	1.931	0.001		0.001	-0.311	8.394	73	41
26	7.511	25	1.878	2.282	8.925		14.874	-0.310	3.130	73	35
27	7.174	49	3.522	2.179	4.121		6.868	-0.311	5.870	74	38
28	6.558	55	3.638	2.034	3.134		5.224	-0.310	6.063	75	41
29	2.338	100	2.334	1.832	0.004		0.006	-0.310	3.891	76	64
30	1.240	90	1.231	1.146	0.009		0.015	-0.268	2.051	77	69
31	1.113	100	1.113	0.698	0.000		0.000	-0.309	1.855	76	66
SUM	181.798	-	119.619	66.065	78.984	N.A.	131.640	-0.644	109.365	-	-
AVG	5.864	56	3.859	2.131	2.548	N.A.	4.246	-0.311	6.431	75	46
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE COOLING SUBSYSTEM

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VIRGINIA SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MON.	SPACE COOLING LOAD MILLION BTU	SOLAR FR. OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG DRY BULB TEMP F	AMB TEMP DEG F
1	0.000	0	0.000	0.000	0.000	0.000	N	0.000	N	75	44
2	0.000	0	0.000	0.000	0.000	0.000	O	0.000	O	75	43
3	0.000	0	0.000	0.000	0.000	0.000	T	0.000	T	73	41
4	0.000	0	0.000	0.000	0.000	0.000		0.000		73	44
5	0.000	0	0.000	0.000	0.000	0.000	A	0.000	A	75	56
6	0.000	0	0.000	0.000	0.000	0.000	P	0.000	P	75	45
7	0.000	0	0.000	0.000	0.000	0.000	P	0.000	P	75	40
8	0.000	0	0.000	0.000	0.000	0.000	L	0.000	L	75	44
9	0.000	0	0.000	0.000	0.000	0.000	I	0.000	I	75	47
10	0.000	0	0.000	0.000	0.000	0.000	C	0.000	C	73	49
11	0.000	0	0.000	0.000	0.000	0.000	A	0.000	A	71	30
12	0.000	0	0.000	0.000	0.000	0.000	B	0.000	B	73	35
13	0.000	0	0.000	0.000	0.000	0.000	L	0.000	L	75	47
14	0.000	0	0.000	0.000	0.000	0.000	E	0.000	E	75	48
15	0.000	0	0.000	0.000	0.000	0.000		0.000		73	26
16	0.000	0	0.000	0.000	0.000	0.000		0.000		75	34
17	0.000	0	0.000	0.000	0.000	0.000		0.000		74	45
18	0.000	0	0.000	0.000	0.000	0.000		0.000		75	48
19	0.000	0	0.000	0.000	0.000	0.000		0.000		76	43
20	0.000	0	0.000	0.000	0.000	0.000		-0.000		76	45
21	0.000	0	0.000	0.000	0.000	0.000		0.000		77	48
22	0.000	0	0.000	0.000	0.000	0.000		0.000		77	54
23	0.000	0	0.000	0.000	0.000	0.000		0.000		76	56
24	0.000	0	0.000	0.000	0.000	0.000		0.000		75	53
25	0.000	0	0.000	0.000	0.000	0.000		0.000		73	41
26	0.000	0	0.000	0.000	0.000	0.000		0.000		73	35
27	0.000	0	0.000	0.000	0.000	0.000		0.000		74	38
28	0.000	0	0.000	0.000	0.000	0.000		0.000		75	41
29	0.000	0	0.000	0.000	0.000	0.000		0.000		75	64
30	0.000	0	0.000	0.000	0.000	0.000		0.000		77	69
31	0.000	0	0.000	0.000	0.000	0.000		0.000		76	66
SUM	0.000	-	0.000	0.000	0.000	0.000	N.A.	-0.000	N.A.	-	-
AVG	0.000	0	0.000	0.000	0.000	0.000	N.A.	-0.000	N.A.	75	46
NBS	Q502	N500	Q500	Q503	Q501		Q508	Q512	Q514	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VIRGINIA SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	924	N	44	49	N	N	N
2	1992	O	43	50	O	O	O
3	1216	T	41	45	T	T	T
4	51		44	43			
5	100	A	56	58	A	A	A
6	258	P	45	46	P	P	P
7	2117	P	40	50	P	P	P
8	1808	L	44	55	L	L	L
9	1850	I	47	57	I	I	I
10	247	C	49	51	C	C	C
11	1606	A	30	39	A	A	A
12	2281	B	35	42	B	B	B
13	2003	L	47	56	L	L	L
14	884	E	48	52	E	E	E
15	2324		26	27			
16	2295		34	43			
17	2248		45	58			
18	1717		48	59			
19	2233		43	53			
20	2246		45	55			
21	2227		48	59			
22	2155		54	67			
23	1699		56	64			
24	273		53	57			
25	700		41	41			
26	920		35	37			
27	1522		38	44			
28	2255		41	48			
29	1844		64	77			
30	1297		69	78			
31	606		66	73			
SUM	45898	N.A.	-	-	-	-	-
AVG	1481	N.A.	46	52	N.A.	N.A.	N.A.
NBS ID	0001		N113			N115	N114

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
THERMODYNAMIC CONVERSION EQUIPMENT

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VI SOLAR/2036-79/03
REPORT PERIOD: MARCH,1979

DAY OF MONTH	EQUIPMENT LOAD MILLION BTU	THERMAL ENERGY INPUT MILLION BTU	OPERATING ENERGY MILLION BTU	ENERGY REJECTED MILLION BTU	COEFFICIENT OF PERFORMANCE (SEE NOTE)
1	0.010	0.000	0.000	NOT APPLICABLE	0.000
2	0.005	0.000	0.000		0.000
3	0.013	0.000	0.000		0.000
4	0.001	0.000	0.000		0.000
5	0.000	0.000	0.000		0.000
6	0.001	0.000	0.000		0.000
7	0.005	0.000	0.000		0.000
8	0.018	0.000	0.000		0.000
9	0.014	0.000	0.000		0.000
10	0.016	0.000	0.000		0.000
11	0.013	0.000	0.000		0.000
12	0.011	0.000	0.000		0.000
13	0.010	0.000	0.000		0.000
14	0.023	0.000	0.000		0.000
15	0.036	0.000	0.000		0.000
16	0.009	0.000	0.000		0.000
17	0.018	0.000	0.000		0.000
18	0.036	0.000	0.000		0.000
19	0.030	0.000	0.000		0.000
20	0.024	0.000	0.000		0.000
21	0.027	0.000	0.000		0.000
22	0.020	0.000	0.000		0.000
23	0.027	0.000	0.000		0.000
24	0.024	0.000	0.000		0.000
25	0.037	0.000	0.000		0.000
26	0.016	0.000	0.000		0.000
27	0.005	0.000	0.000		0.000
28	0.010	0.000	0.000		0.000
29	0.005	0.000	0.000		0.000
30	0.004	0.000	0.000		0.000
31	0.007	0.000	0.000		0.000
SUM	0.475	0.000	0.000	*	0.000
AVG	0.015	0.000	0.000	*	0.000

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.
NOTE: